The Effect of Household Hospitalizations on the Educational Attainment of Youth

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Abstract:

We utilize data from the NLSY97 to investigate the effect of week-long hospitalizations of household members on the educational attainment of youth. These significant household health events could result in a combination of financial and time constraints on the household, limiting the educational opportunities available to students. We find that household hospitalizations lead to reductions in the likelihood of completing high school, attending college and completing a bachelor's degree. These negative effects are disproportionately experienced by male youth. Students with higher pre-hospitalization ability appear to be insulated from these health events. Birth-order and the gender composition of siblings also appear to play a role. We find that the oldest children in the household bear the burden of a hospitalization, substantially lowering the educational attainment of these youth, while insulating their younger siblings. Similarly, the presence of a brother appears to insulate youth from the negative impacts of household hospitalizations.

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1. Introduction

Using data from the National Longitudinal Survey of Youth 1997 (NLSY97), this paper investigates the impact of a week-long hospitalization of a household member on the educational attainment of youth in these households. We argue that hospitalizations of this length proxy for significant health events of the household member, conditional on a rich set of background controls including measures of household and youth health, income, wealth, demographics and student ability measured prior to the hospitalization. We find such substantial hospitalizations of household members lower the educational attainment of youth within the household. Furthermore, we find that the effects are concentrated among male youths, youth without older siblings and youth without brothers, suggesting a possible protective role for male and older siblings in response to the hospitalization event.

In the United States, hospitalizations are not infrequent occurrences, occurring at a rate of 936.7 per 10,000 people in 2007 (Hall et a. 2010). However, only 13% of hospitalizations result in a length of stay exceeding a week.[1] Such significant hospitalizations of household members due to severe health events may negatively impact educational decisions and outcomes of healthy youth in these households through a variety of channels. The hospitalization of household members may impose psychological stress on the children in the afflicted families. Alternately, illnesses of household members could affect household income or put constraints on the available time of household members because of care needs or changes in labor market behavior. Thus, hospitalizations may limit financial and time investments in children, which could negatively impact the educational outcomes of youth. In addition to restricting the resources available to be invested in children, the adverse health event may place direct requirements on children by requiring them to actively care for the afflicted member or

[1] All length of stay calculations performed by authors' using the 2002 National Hospital Discharge Survey.

participate in the labor market to offset resulting income reductions. Consistent with these concerns, a recent survey of high school dropouts conducted by the Bill and Melinda Gates Foundation found that 22 percent of these students reported that the primary reason for their dropout was the necessity of caring for a family member (Bridgeman, DiIulio and Morison, 2006).

A large literature has focused on linkages between socioeconomic status (SES) and health. (See Currie (2009) for a survey.) This literature documents correlations between parental SES and children's health, and a reciprocal link between child health and the subsequent SES of the child in adulthood. A similarly large literature has examined the impact of various household resources on educational attainment, investigating the role of family income (e.g. Cameron and Heckman (1998, 2001); Carneiro and Heckman 2002; Belley and Lochner 2007), parental education (Altonji and Dunn 1996) and housing wealth (Lovenheim 2010; Lovenheim and Reynolds 2013). In general, this literature has found that lower resources lead to lower educational attainment of youth, but the exact mechanisms are still being uncovered. The evidence suggests that the impact of household resources may differ depending on the age of the child or the student's point in the educational path. For example, differences in resources at young ages can lead to substantial long-run differences in educational attainment (Cunha et al. 2006; Cunha and Heckman 2007).[2] Given large and increasing returns associated with education (Autor, Katz and Kearney, 2008), understanding the complex ways in which

[2] A related literature has investigated whether credit constraints limit college enrollment for some students. Carneiro and Heckman (2002), Cameron and Taber (2004) and Stinebrickner and Stinebrickner (2008) find that credit constraints do not play a large role in college enrollment and completion for most students, while Belley and Lochner (2007) find evidence of an increasing role over time for family income in both college attendance and college choice decisions. However, this discussion is largely not about whether household resources matter, but instead is focused on whether there is a role for short-run credit constraints late in the educational path, given long-term differences in household resources.

household health events affect educational attainment is a matter of importance for policy purposes.

Some literature directly investigating the effects of family health events on the educational and labor market outcomes of children has recently emerged. Sun and Yao (2010) use rural data from China to examine the effects of health events to adult family members on the educational outcomes of children, finding significant negative effects on the enrollment of primary school students. Choi (2011) uses Russian data to document lower probabilities of labor force participation and lower educational attainment of daughters, associated with changing health status of their fathers. A working paper by Bratti and Mendola (2011) suggests that the children of mothers who experience health declines are less likely to be enrolled in secondary and tertiary education in a Bosnian data set. All of the previous studies use data from countries undergoing economic transitions and therefore the policy relevance for the United States is unclear. In contrast, a 2010 working paper by G. Brant Morefield uses the Child Development Supplement of the Panel Study of Income Dynamics to investigate the effect of negative parental diagnoses of specific health events on children in the United States. Morefield finds no significant effect on children's cognitive skills, but finds small negative effects on children's behavior. Adverse parental diagnoses are shown to have more pronounced negative effects on son's behavior in comparison to daughter's, and are more pronounced when the diagnosed parent is the father.[3]

[3] A number of small scale studies in the medical and child psychology literature also investigate the behavioral and emotional outcomes of children whose parents are diagnosed with acute illnesses. Visser, et al. (2004) provide a meta-analysis of 52 studies of the children of cancer patients, finding increased emotional problems and incidence of depression among the children. Spath (2007) surveys 6 studies investigating the effectiveness of psychological counseling for children in families with members diagnosed with serious illness, finding some evidence that counseling was beneficial in the children's psychological adjustment to the diagnosis. Sieh, et al. (2010) perform a meta–analysis of 19 studies of the children of chronically ill parents, providing evidence that problem behavior is more prevalent in the children of the diagnosed parents. The studies surveyed in the Visser, et al. (2004), Spath

This paper builds on this nascent literature by providing a longitudinal study of the effects of a significant household hospitalization event on the educational attainment of children in the NLSY97, a large scale, representative sample in the United States. Our identification strategy combines the timing of the questions with the rich set of individual and household covariates available in the NLSY97. Students are initially surveyed in 1997 and provide information about household finances, youth and household health, and other household characteristics. Additionally, the students are given the Armed Services Vocational Aptitude Battery (ASVAB), a series of tests that are used extensively in the literature to control for student ability and long-term household investments in youth (e.g. Cameron and Heckman (1998, 2002); Carneiro and Heckman 2002; Cameron and Taber 2004; Belley and Lochner 2007). Students are then asked whether any member of the household has experienced a week-long hospitalization in follow-up surveys.[4] Thus, the base year data on youth and household health, student ability and household finances, as well as other characteristics represent pre-hospitalization controls. Our identifying assumption is that given the rich base year controls, the household hospitalizations provide a proxy for conditionally exogenous health events of household members.

The household hospitalization variable captures events that likely have substantial impacts on households, as a week-long hospitalization indicates a serious diagnosis. The National Hospital Discharge Survey administered by the Centers for Disease Control and Prevention documents that the median length of hospitalization in 2002 was 3 days for all diagnoses. Diagnoses resulting in hospitalizations approaching a week in duration, representing

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(2007) and Sieh et al. (2010) papers suffer from small sample sizes, with the largest individual study considered involving 336 participants, while the vast majority of the studies considered utilize sample sizes under 100 children.

[4] The youth's objective report on the week long hospitalization of a household member has the advantage of limiting the potential biases associated with subjective measures of health status or self-reported health (Bound 1991).

only 13% of all hospitalizations, include malignant neoplasms (6 days median length of stay), femur fracture (5.0 days) and septicemia (6.0 days). For comparison, the median length of stay for acute myocardial infarction was 4 days, for appendicitis was 2 days, for childbirth was 2 days, and most elective surgeries are performed on an outpatient basis. As a result, our measure likely captures serious diagnoses or extremely acute occurrences of conditions like myocardial infarction.

Thus our measure of a week-long hospitalization proxies for significant health events of household members which are likely to result in resource constraints on the household. For example, following a heart attack an individual may return to work within two weeks to three months depending on the severity of the heart attack, and treatment of cancer can have on-going serious physical effects on patients and force children to take on more responsibilities within the household.[5] Our proxy measure is similar in spirit to Sun and Yao (2010) who use large medical outlays, approximately twice the average rural income in China, as a proxy for severe health events in households in rural Chinese households. However, our measure of length of hospitalization is likely a better proxy than medical outlays for severe health events in the United States, given the complex role that insurance coverage could have on medical expenses.[6]

We find that a week-long household hospitalization during the youth's adolescence lowers the likelihood of completing high school by age 20, with the negative impact particularly falling on male youth. Additionally, we find some evidence that students in households experiencing a hospitalization event are less likely to attend college, and we find that they are

[5] Information gathered from the family resource sections of the websites of the American Heart Association (www.heart.org) and the National Cancer Institute (www.cancer.gov).

[6] For example, elective surgeries may not be covered by insurance and therefore would cause a large outlay without substantial change in health. Additionally, the measure of health shock in Sun and Yao (2010) also includes conditions resulting in any inpatient care, possibly including less acute conditions resulting in short stays that would not be included in our measure.

much less likely to complete college, even in the sample of high school completers. Consistent with the evidence on high school completion, male youths appear to experience larger negative effects of a hospitalization on college completion. Furthermore, we find some evidence that household hospitalizations restrict the college choice set of students.[7] Given the evidence in the literature of large economic returns to college completion, we would expect household hospitalizations to negatively affect future earnings, which we find in the data. These results, in combination with the relatively large proportion of youth who experience household hospitalizations, suggest that household health events could be an important mechanism for determining educational and earnings attainment.

Correctly formulating policy responses to household hospitalizations involves identifying the mechanisms through which household health events affect educational outcomes of youth. However, these channels can be quite complex because of the variety of ways in which households can adjust behavior and substitute between resources in response to a significant hospitalization. While we cannot identify all of the exact mechanisms using our data, we are able to begin unraveling some of the channels by investigating how the effect of a household hospitalization varies across student and household characteristics. We do not find strong evidence that the effect of household hospitalization varies across family income or student ability. However, we do find that households appear to shift the burden of household health events differentially across children within the household based on birth order and gender composition. The negative effects of a household hospitalization are concentrated among the oldest children within the household. For example, having an older sibling appears to reduce the

[7] There is increasing evidence of negative effects on the educational attainment and labor market earnings of two-year college attendees (Kane and Rouse 1995; Long and Kurlaender 2009; Reynolds 2012; Bound, Lovenheim and Turner 2010), but there could also be consequences for students if the limited choice set lowers the match quality between the student and college (Light and Strayer 2000).

magnitude of the estimated effects. Similarly, the presence of a brother in the household also diminishes the impact of a household hospitalization. Thus, it appears that older children and male children bear the brunt of the negative effects of the health event, but in doing so these youth insulate their siblings from the detrimental effects of a household hospitalization.

We begin with a discussion of our empirical methodology and data in Section 2. We present initial results in Section 3 of the effect of household hospitalizations on educational attainment, using a variety of empirical specifications. In Section 4, we investigate how the effects are mediated or accentuated based on characteristics of the youth or the youth's household and discuss the implications for the mechanisms linking household hospitalizations to child educational outcomes. Section 5 examines the impact of hospitalizations on the choice of college attended for the subsample of college attendees, and briefly looks at labor market earnings. Section 6 concludes.

2. Methodology and Data

We begin with a simple framework for how household health events can impact educational attainment of youth. In the initial period *t*, we observe a set of background characteristics about the youth (X_t) and the household (W_t). In period *t+1*, the household may experience a health event of a household member (Z_{t+1}) and then we observe a level of educational attainment in period *t+2*. Thus, future educational attainment of youth can be modeled as

$$E_{t+2} = f(Z_{t+1}, X_t, W_t) \qquad (1)$$

where *E* is a measure of educational attainment. In our empirical approach we consider a variety of educational outcomes including years of schooling and measures of education milestones such as degree attainment.

This framework requires a dataset with several measures: first, measures of household health events, second, educational outcomes, and third, a rich set of covariates providing background controls for the youth and household prior to the health event.[8] All three categories of variables are available in the NLSY97, a nationally representative sample of youth aged 12-18 in 1997. The project initially interviewed 8,984 individuals and their parents in 1997, providing detailed background information on the students and their families. In the base year, students are also given a battery of standardized tests. Importantly, these background characteristics and tests occur before the household health events are observed in the data, thus these measures can help to control for the initial ability of the youth and characteristics of households. The youth have been interviewed annually since 1997, providing researchers detailed histories of educational choices and outcomes.

In the 2002 survey year, respondents were asked whether anyone in their household had been hospitalized for at least a week in the previous 5 years. Conditional on answering "yes" to this question, respondents were asked about the identity of the individual hospitalized. Our main variable of interest is an indicator that takes a value of one if any member of the youth's household, other than the youth themselves, experienced a one-week hospitalization in the previous five years. In our regression sample, approximately 17% of youth report such an event in their households. We initially focus on any hospitalization within the household but we also consider whether the impacts are different depending on which member of the household was hospitalized.

[8] Datasets with detailed health questions typically do not have student educational outcomes or measures of pre-shock human capital, such as standardized test scores. Educational datasets have detailed information either do not have health information, or the health information included is subjective or self-reported. Subjective, self-reported measures of health status are argued by Bound (1991) to suffer from endogeneity problems. In contrast, objective, self-reported measures of health status (regarding specific conditions rather than general well-being) are vulnerable to measurement error as demonstrated in Bound (1991), as well as Baker, Stabile, and Deri (2001).

There are several advantages to this particular measure of a health event. First, as discussed previously, hospitalizations of this length are likely to be associated with substantial health events or significant changes in the health of household members. Second, this measure is less subjective than the health information in many other surveys because it only requires youth to identify length of hospitalization, and not the severity of the health event that led to the hospitalization. Moreover, the youth is responding to questions regarding other members of their household, rather than providing a self-report, which is likely to be less susceptible to endogeneity problems.

There are some limitations of the measure, however. First, because the question deals with only week-long hospitalizations, we may miss important health events that result in frequent hospitalizations of short duration. Second, we do not know whether the hospitalized individual had multiple hospitalizations. Thus, while we are likely capturing significant health events due to the length of hospitalization, we cannot distinguish additional levels of severity. To the extent that our measure does not detect potentially serious health events, the results presented below may attenuate the effect of a household hospitalization.[9] An additional limitation of the measure is that we do not know when during the five-year period the hospitalization occurred. This limits our ability to identify immediate impacts of the hospitalization on youth behavior and educational choices. We instead examine how the effects of hospitalizations are manifest in educational attainment.

The primary identification concern is that the observed hospitalization is not exogenous, and is correlated with unobserved factors influencing youth's educational attainment. In this

[9] If a household member has a serious decline in health but is not hospitalized for at least a week during the five-year window in our data, they will appear in the non-hospitalization sample. If the effect of this condition is to lower the educational attainment of the youth in these families, this measurement error will attenuate our estimated effect of a household hospitalization.

case, the coefficient on the hospitalization variable will be biased. Given the impossibility of a randomized control study on hospitalization events, our identification strategy relies on using an extensive set of base year controls for the youth (X_t) and the household (W_t), measured 1997 before the household hospitalization. For the household, we include measures of base year household health including measures of parental Body-Mass Index (BMI) as categories (normal weight, underweight, overweight and obese) as well as an indicator for whether the parent is limited by health from working. Additionally, there is an extensive literature linking parental socioeconomic status to child health, and child health to subsequent educational and labor market attainment (see Currie (2009) for a detailed survey of this literature).[10] Therefore, we include base year household income and household net worth as two measures of financial resources of the household. These measures capture differences in resources available to households and also will capture long-term differences across households that may affect youth educational attainment, such as prior health problems not captured by our direct health measures or differences in household discount rates affecting savings decisions. Finally, one might be concerned that there are effects of parental socio-economic status that are not captured by the income variable, consequently we also include the years of schooling of the youth's mother and father separately.

In addition to the household controls, we include a rich set of covariates for the youth. These controls include the same categories of BMI as for the parents as well as an indicator for whether the youth is limited in their ability to work for pay or do schoolwork because of a health

[10] Currie and Moretti (2007) document intergenerational correlations in birth weight. Papers linking low birthweight to diminished schooling attainment and labor market outcomes using studies of twins include Behrman and Rosenzweig (2004), Black, Devereux and Salvanes (2007), Royer (2009) and Fletcher and Lehrer (2009). Natural experiments indicating fetal origins of later life health include Banerjee, Duflo, Postel-Vinay and Watts (2010) and Almond and Mazumder (2011). Finally, a large literature finds general infant health to also be a strong predictor of educational and labor market outcomes, including Case, Fertig, and Paxson (2005), Oreopoulos, Stabile, Walld and Roos (2008), Currie, Stabile, Manivong and Roos (2010) and Fletcher (2011). See Currie (2009) for a detailed survey of this literature. Eide and Showalter (2011) provide an overview of recent developments.

condition. We also include indicators for whether the youth has been diagnosed with various chronic conditions including asthma, a heart condition, anemia, diabetes, cancer or other chronic condition. These additional health controls capture pre-hospitalization health problems of the youth that may affect educational attainment, as well as other unobserved genetic or environmental health factors of the household.

The youth controls also include the student's score on the Armed Forces Qualifying Test (AFQT), a subcomponent of the ASVAB which provides a comprehensive test of cognitive skills, and is given to youth in the first year of the survey. It has been argued in the literature (e.g. Cameron and Heckman (1998, 2002); Carneiro and Heckman 2002; Belley and Lochner 2007) that AFQT scores represent long-term resources invested in children. Thus, the student's score on this test can be interpreted as measuring investments made in the youth prior to the hospitalization and would include any long-run household health conditions that limit such investments in the youth.

To further control for differences between hospitalization and non-hospitalization households, we also include other covariates from the base year of the survey. We include basic demographics of race and gender of the youth, as well as the number of the youth's siblings. Because we are interested in educational outcomes, we also control for characteristics of the youth's high school to capture other unobserved differences in educational opportunities. In particular, we include measures of whether the student's high school is public and an indicator for large student-teacher ratio, exceeding 22 students per teacher.[11] We also include indicators for living in the non-central city portion of a Metropolitan Statistical Area (MSA) or living

[11] It is possible that household hospitalizations affect the type of high school that the student attends, in which case we are controlling for an endogenous variable. We investigated this issue and found little evidence that household hospitalizations affect the characteristics of the high school that the student attends. However, to the extent that hospitalizations lead to lower quality educational options for youth during high school, our specification will underestimate the true effects of a hospitalization on youth educational attainment.

outside a MSA at age 17. Finally, we include age fixed effects to account for any differences across cohorts in educational experiences or hospitalizations. For example, business cycles could induce a correlation between hospitalizations and educational choices as both schooling decisions and health and medical utilization are correlated with business cycles (Ruhm 2003). Including age effects accounts for this potential correlation.

Our identifying assumption is that the hospitalization event is exogenous conditional upon these controls, which capture both differences in household characteristics and individual health conditions. This precludes, for example, nonrandom hospitalizations due to effects of long-term household health conditions that may also impact youth educational attainment, as such long-term conditions would be captured in the base year controls. Any bias in our estimates of household hospitalization's effect on youth educational attainment must be due to unobserved effects that are residual to the extensive pre-hospitalization household characteristics that we include in the model, including our extensive set of parental and youth health measures, household income and net worth and student test scores. Furthermore, we will also present evidence that the negative effects of household hospitalizations are concentrated among male youth, youth without older siblings and youth without brothers. Thus, any bias due to unobserved effects must not only be residual to our extensive pre-hospitalization controls, but must also operate in such a way as to only emphasize male youth, or youth without older siblings or brothers. While such selection is possible, we believe that it is unlikely given the rich set of covariates that we employ.

The NLSY97 contains several measures of youth health surveyed in 2007, five years after the household hospitalization variable is assessed, allowing a straightforward test of the conditional exogeneity of the household hospitalization indicator with respect to youth health.

We estimated probit regressions of indicators of future health of the youth on the control variables and the household hospitalization indicator. We considered two dependent variables: a binary indicator of youth self-reported good health and week-long hospitalizations of the youth in the five year period after the household hospitalization event. In both regressions, the marginal effect of a household hospitalization has the opposite sign from what we would expect if hospitalizations were proxing for poor youth or household health, although neither result is statistically significant.[12] These results demonstrate that the hospitalization indicator is not capturing family specific effects, such as poor family health status, which result in diminished youth health, subsequently causing lower educational attainment.[13] Rather, the household hospitalization indicator identifies a conditionally exogenous change which affects the youth's educational attainment, independent of the youth's health status.

One limitation of the NLSY97 data set is item non-response. Given the primacy of the household hospitalization variable, we limit the sample to those youth who respond to the hospitalization question, which removes 1,101 observations, or roughly 12 percent of the sample. Note that all but 13 cases of missing information regarding hospitalization are due to those youth who did not participate in the 2002 survey. Because of the critical importance of the base year health measures, student ability and household income and wealth variables, we exclude all youth for whom this information is missing, a restriction that is common in the literature (Carneiro and Heckman 2002; Cameron and Taber 2004; Belley and Lochner 2007). This removes an additional 3,514 observations missing some combination of these variables. For

[12] The marginal effect of a hospitalization on future youth self-reported health being rated as "excellent" or "very good" is 0.007 (0.012) and the marginal effect on a future week-long hospitalization of the youth is -0.019 (0.014).
[13] In our data, 95 percent of those youth experiencing a household hospitalization event only have a single household member hospitalized during the five-year observation period. This provides additional evidence that there is not a correlation in hospitalizations within households, which would be suggestive of unobserved household characteristics driving hospitalizations.

parental education, we include an indicator for missing education but restrict the sample to those youth for whom at least one parent has reported education. Restricting the sample to youth that report the additional controls produces a final sample of 3,862 individuals. As a robustness check, we estimated all of our main specifications using multiple imputation of the AFQT, household income and household net worth, the three variables for which we have the most missing data, by multiple imputation by chained equation (MICE) developed by Van Buuren, Boshuizen and Knook (1999).[14] This results in a sample of 6,034 observations. As we will discuss, results from this procedure are not substantially or substantively different, but in many cases are stronger, than our estimates reported in the main paper based on dropping observations with missing data.

Summary statistics are provided for the full regression sample in the first two columns of Table 1. As discussed above, 16.6 percent of youth experience a one-week hospitalization of a household member in the 5 years before 2002 while 11.8 percent of youth experience a one-week hospitalization of a member of their nuclear family. Approximately 82 percent of the regression sample completes a high school degree by the age of 20 and approximately 63 percent attend college by the age of 21. Finally, 28 percent of the regression sample completes a bachelor's degree by 2008.

Table 1 also presents summary statistics separately for the sample of youth for whom a household member is hospitalized and for the non-hospitalization sample. Differences in the means of the two samples are presented in the last column with asterisks denoting statistical significance. The hospitalization sample has slightly lower AFQT scores, household income and

[14] The NLSY97 provides a rich set of covariates upon which the imputation can be performed. In addition to the variables used in the empirical analysis, we also use high school GPA, the PIAT math exams scores, household income when students are 17, homeownership, house value and MSA-level means of all covariates. The imputation procedure is implemented using the STATA module "ICE" (Royston, 2004) with ten cycles of regressions and performed five separate times.

household net worth, although none of the differences are statistically significant. In fact, the differences in sample means for almost all variables are small and not statistically significant at the 10 percent level. The exceptions are the direct measures of health, with the hospitalization sample having a higher likelihood of youth and parents having health limitations that limit work or school. The hospitalization sample also has a somewhat higher rate of parental and youth obesity and the youth themselves are more likely to have a chronic condition in the base year. However, most of these differences between the hospitalization and non-hospitalization samples are small. While the estimates of the effects of household hospitalizations presented below control for these differences by employing our extensive set of pre-hospitalization background controls, there is scant evidence that there is selection into the hospitalization sample based on observable characteristics.

3. The Effect of Household Hospitalizations on Educational Outcomes

3.1 OLS Estimates of Years of Schooling

We begin by estimating the effect of household hospitalizations on youth educational attainment with an OLS regression of total years of schooling on our household hospitalization indicator and the full set of base year controls previously discussed, including youth and parental health measures, household income and wealth, parental educational attainment, and student ability.[15] The estimated coefficient on the household hospitalization variable is presented in column (1) of the top panel of Table 2 and indicates that such an event reduces total years of schooling by 0.142 years, although the effect is not statistically significant at conventional levels. However, the point estimate represents a substantial effect of a household hospitalization on the educational outcomes of youth relative to the contribution of other covariates (full results for all

[15] All models in the paper are estimated using appropriate sampling weights. Furthermore, robust standard errors are reported in the tables in parentheses below point estimates or marginal effects.

covariates are presented in Table A-1). Comparing the magnitudes of the effects suggests that a household hospitalization has the equivalent effect of having approximately $30,000 lower household income or approximately $80,000 lower household net worth. Similarly, a hospitalization is equivalent to having between a 3 to 4 point decrease in the percentile score on the AFQT, roughly equivalent to a 0.10 to 0.15 standard deviation decrease.

In column (2), we present the estimates including an interaction between the household hospitalization indicator and an indicator for female. The coefficient on the household hospitalization indicator suggests that for male youth, a household hospitalization reduces total years of schooling by 0.316. The interaction term indicates that this entire effect is eliminated for female youth, suggesting that male youth are more susceptible to the hospitalization of a household member. There are many possible reasons that such a gender pattern could emerge. One possibility is simply that male youth are an increasingly at-risk population with respect to educational attainment (Goldin, Katz and Kuziemko 2006) and therefore are more likely to have their academic careers disrupted by the health event. Alternately, it is possible that male youth bear the burden as households reallocate responsibilities following the hospitalization. Evidence suggests that women are more likely to provide care for household members while men may be more likely to provide financial assistance, resulting in differential gender effects depending on how households respond to the hospitalization of a member (See, for example, Checkovich and Stern (2002), Engers and Stern (2002), and Byrne et al. (2009).). In Section 4, we provide some evidence suggesting that, in fact, male youth may be sheltering their siblings by shouldering an additional burden following a hospitalization.

3.2 Probit Estimates of Education Milestones

Using total years of schooling completed to measure youth education assumes that each year of schooling has the same impact on educational attainment. However, this linearity assumption ignores the possibility of sheepskin effects associated with degree attainment and that household hospitalizations could have different effects along the educational career, the knowledge of which is important for developing policy responses. Therefore, as an alternative, we estimate our model using probit regression for three binary educational outcomes: completion of a high school degree before age 20, college attendance before age 21 and completion of a bachelor's degree.

There is an ancillary identification issue particular to the high school completion and college attendance outcomes. Given the age range in our data, older youth in the base year may complete these two outcomes before 2002 and thus the reported hospitalization could occur after the educational attainment has been measured. To limit this possibility, we impose age restrictions so the only youth included in the regression are those for whom the educational attainment is measured after the hospitalization period. For example, the hospitalization is known to occur between 1997 and 2002 and we measure whether a high school diploma is achieved before age 20. Thus, we limit the regression sample to those youth aged 12-15 in the base year, who are therefore aged 17-20 in 2002, ensuring that the high school completion is measured after the period in which the hospitalization took place. Similarly, we measure college attendance by age 21, so we limit the regression sample for this outcome to those youth aged 12-16 in the base year. Because BA attainment occurs after 2002 for the entire sample, we do not place any age restriction on that outcome.[16]

[16] There is a potential related timing concern associated with students dropping out of high school prior to the hospitalization. The age restrictions we employ limit, but do not eliminate, this possibility. We have estimated several auxiliary regressions and find no evidence that this concern is driving our results. In particular, as a falsification test we estimated a regression of high school completion by age 18 in the sample of youth aged 16-17 in

Similar to our OLS estimates for years of schooling, we estimate the probit model both for the full sample and with an interaction of our household hospitalization indicator and an indicator for female. As noted in Ai and Norton (2003), the correct marginal effect of an interaction variable in a nonlinear model is conditional on the independent variables and is not equal to the marginal effect of the interaction term. In practice, meaningfully interpreting the marginal effect of two binary interaction variables requires changing the level of one of the variables while holding the other binary variable constant. For example, we report the marginal effect of changing hospitalization from zero to one while holding female to 0, and subsequently holding female to 1.[17] These estimates correspond to the marginal effect of hospitalization experienced by male and female youth.

The point estimate in column (3) of the middle panel of Table 2 suggests that a household hospitalization reduces the likelihood of completing high school by 1.6 percentage points, although the estimate is not statistically significant. However for male youth, the marginal effect of a household hospitalization lowers the likelihood of high school completion by a statistically significant 5.1 percentage points while the marginal effect for female youth is small and not statistically significant. We further find that a household hospitalization reduces the likelihood of all youth attending college by -3.2 percentage points (column (5)) and a similar magnitude effect for both male and female youth (column (6)), but the effect is not statistically significant for the full sample or for either gender.

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the base year, for whom any hospitalization is more likely to follow high school completion. If such a timing pattern was driving our estimates we would expect to find a negative effect of hospitalization, but instead we find a *positive* but statistically insignificant effect of hospitalization on high school graduation. Similarly, in the sample of high school dropouts, we estimate that hospitalizations are associated with more years of schooling and higher grade point averages, although neither is statistically significant, suggesting that those youth who experience household hospitalizations are not predisposed to dropping out relative to the non-hospitalization sample. Furthermore, we later present evidence in Appendix Table A-2 that hospitalizations are associated with decreased likelihoods of college completion, even among those students who successfully complete high school.

[17] The marginal effects presented are calculated using the Stata "margins" command, evaluated at the sample averages for all other covariates.

Additionally, in column (7) we find that a household hospitalization lowers the likelihood of completing a BA by 4.0 percentage points. Similar to the estimates for years of schooling and high school completion, in column (8) we find a strong gender effect in the estimates. For male youth a household hospitalization lowers the likelihood of BA completion by 6.6 percentage points but there is not substantive or statistically significant effect for female youth. Additionally, the magnitudes of the marginal effects suggest that the effect of hospitalizations on BA attainment does not operate solely through students dropping out of high school. In fact, in Appendix Table A-2 we present the estimates of the effects of hospitalizations on BA attainment in the sample of high school graduates and find that hospitalizations have a substantially negative and statistically significant impact on BA attainment even among high school graduates.[18]

Additionally, the marginal effects presented in Table 2 represent large changes in educational attainment relative to the baseline outcome probabilities, particularly for the college outcomes for which the baseline probabilities are lower. The baseline likelihoods of completing high school and attending college in the regression samples is 81.7 and 62.8 percent, respectively. Therefore, a household hospitalization lowers the likelihood of high school completion by 2.0 percent ($= \frac{-0.020}{0.817} \times 100$) relative to the baseline, and lowers the likelihood of college attendance by 5.1 percent ($= \frac{-0.035}{0.628} \times 100$). Additionally, the likelihood of completing the BA is reduced by 14.3 percent ($= \frac{-0.037}{0.280} \times 100$) relative to the average BA completion rate in the sample. Combined with the relatively high frequency of these health events in the data, the

[18] It is possible that hospitalizations differentially impact youth by age. For instance, 12 year olds may be more negatively affected if they are at a more critical developmental period. Alternatively, if youth respond to hospitalizations through increased labor force participation or home responsibilities, then hospitalizations may have a larger negative impact on older youth. Since we cannot identify the point during the five year hospitalization period at which the hospitalization occurs, we are limited in our ability to investigate the age impacts in the NLSY97 sample. We later present results suggesting that younger siblings may be insulated by the presence of an older sibling, indicating that birth order is important. Further refining the effects of hospitalization by age remains a potential area for future research.

estimates in Table 2 suggest that significant household hospitalizations could be an important obstacle to educational attainment.

3.3 Propensity Score Matching Estimates and Selection

In the bottom panel of Table 2, we replicate our previous estimates for all outcomes using propensity score matching (Rosenbaum and Rubin 1983, 1984). Propensity score matching is a two-step semi-parametric procedure to estimate treatment effects. In the first step, we use the household hospitalization as the dependent variable in a probit regression including all of our covariates and then use those estimates to predict the probability that the youth experiences a household hospitalization conditional on the covariates ($\hat{P}(X)$), referred to as the propensity score. In the second step, we use an algorithm to construct for each youth that experiences a household hospitalization, a counterfactual outcome based on the observed outcomes of those youth who had a similar propensity score, but did not experience a household hospitalization. This methodology relies on less restrictive identifying assumptions and, intuitively, pairs like individuals in the hospitalization and non-hospitalization samples. While there are a variety of matching estimators, we use kernel matching with an Epanechnikov kernel with the bandwidth selected by leave-one-out cross validation.[19] Standard errors are produced by bootstrapping the procedure using 1000 replications. We perform the entire method separately for each outcome, as well as separately for male and female youths. The results from this exercise are not substantively different than those found using OLS and probit regression.[20]

[19] Kernel matching constructs the counterfactual outcome using any untreated observation within a specified bandwidth, but placing more weight on the observations whose propensity score is a closer match. As a robustness check, we have also estimated all effects using local linear regression, an alternative specification which accounts for the slope of the conditional expectations function, with the Epanechnikov kernel and found similar results. These results are available from the authors upon request.

[20] As discussed previously, the results are similar and often stronger when we estimate all of our main results in Table 2 using multiple imputation (see Appendix Table A-3).

Despite our rich set of pre-hospitalization controls, there is the possibility that some of the estimated effects of hospitalizations on educational outcomes in Table 2 are due to selection based on some unobserved characteristic. As a sensitivity check, we conduct the procedure suggested by Altonji, Elder and Taber (2005) that uses the magnitude of the selection on observable characteristics as a basis for considering the potential problem of selection on some unobserved characteristics. We find that a substantial, and arguably implausible, amount of selection into hospitalization based on unobserved characteristics that are correlated with lower educational attainment would be required to explain away our main results. Specifically, to explain the negative effect on high school completion, there would need to be 0.48 times as much selection based on the unobserved characteristics as there is for the entire set of observed characteristics. The observed characteristics include a large variety of variables that are known to be strong predictors of student success, including test scores, family income, family wealth, parental education and high school characteristics, as well as our set of youth and household health measures. Similarly, there would need to be 1.11 and 0.73 times as much selection on unobserved characteristics as the set of observed characteristics to eliminate the college attendance and BA completion estimates, respectively. Given the extensive set of observed pre-hospitalization covariates, and the fact that any potential selection on unobserved characteristics would have to be orthogonal to this rich set of observed controls, we argue that selection on unobservable characteristics is unlikely to invalidate the negative impact of household hospitalization on educational attainment found throughout this paper.

3.4 Ordered Probit Estimates

As a further robustness check, in Table 3 we estimate the overall impacts of household hospitalizations on final outcomes using an ordered probit model with four categories of degree

attainment: less than high school, high school diploma, associate's degree, bachelor's degree. All outcomes are measured in 2008. Column (1) in the top panel shows that the household hospitalization indicator produces a statistically significant negative coefficient, consistent with the results in Table 2 that hospitalizations reduce educational outcomes. The bottom panel presents the marginal effects of a hospitalization on not completing high school in column (1a) and completing a BA in column (1b). The marginal effects suggest that a household hospitalization increases the likelihood of not completing high school by 2.0 percentage points and reduces the likelihood of completing the BA by 3.4 percentage points. These impacts are very similar to the estimates in Table 2 except that they are slightly more precisely estimated given the larger sample size. Column (2) presents the coefficients including the interaction of the hospitalization indicator with the indicator for females. Hospitalizations again appear to have a larger negative impact on male youths. The marginal effects in columns (2a) and (2b) in the lower panel also suggest that male youths are hurt more by household hospitalizations and the magnitudes of the marginal effects are similar to those found previously in Table 2.

The estimates thus far have suggested that the hospitalization of any household member has a negative impact on the educational attainment of youth, particularly male youth. In column (3) of Table 3, we investigate whether it matters which member of the household is hospitalized. In particular, we include separate indicators for the hospitalization of the youth's mother, the youth's father or the youth's sibling. These three categories of household members comprise over 70 percent of hospitalizations of household members in our sample. Given the evidence that hospitalizations have a differential impact based on the gender of the youth, we also include interactions with an indicator for whether the youth is female. The estimates in column (3) suggest that the hospitalization of any member of the youth's nuclear family is associated with

substantial negative impacts for men and smaller impacts for women as the sign on the hospitalization coefficients are consistently negative and the coefficients on the interactions are consistently positive. The previous literature in this area have focused primarily on the impact of parental health events (e.g. Morefield (2010), Sun and Yao (2010), Choi (2011) and Bratti and Mendola (2011)), however the results in column (3) suggest that sibling hospitalizations also have a significant negative effect on youth educational attainment. There is little difference in the estimated effects by member hospitalized for either men or women, suggesting that the negative effects of hospitalization are not driven by the family member hospitalized, but are experienced differentially by the gender of the child.

4. Identifying the Transmission Mechanisms of Household Hospitalizations

The estimates in the preceding section suggest a role for policy intervention to offset the substantial negative effects of household hospitalizations on youth educational outcomes. However, constructing appropriate policy requires identifying the mechanisms through which household health events affect youth educational attainment. As discussed previously, such mechanisms could be quite complex to identify, requiring either strong modeling assumptions or specialized data. For instance, given that the hospitalization is of a household member, one might immediately wonder whether access to health insurance moderates the potential negative effects. To fully investigate the role of health insurance would require information on the existence of coverage, in addition to detailed information on the extent of coverage of the affected household member. For example, because hospitalizations could affect either income or time resources, researchers would need to know about the size of out-of-pocket costs, whether in-home care is covered, or whether the affected member has long-term care and/or disability insurance. Unfortunately, in the NLSY97 health insurance data is limited to whether or not the

youth (and not the affected household member) is covered by health insurance and the source of that coverage (employer-provided, government-provided, or privately purchased). The use of the coverage variable to identify the role of health insurance is further weakened because 90.3 percent of youth are covered by some form of insurance. Estimates including an indicator for coverage and an interaction with the hospitalization indicator proved insignificant for all outcomes, consistent with our expectations given the data limitations.

We would also ideally want to observe the changes in household income and labor force behavior of household members following the hospitalization. However, household income after the base year suffers from large item non-response in the NLSY97 and detailed data on hours worked after the base year are only available for the youth. We find that hours worked by the youth during high school, regardless of gender, were not significantly affected by hospitalizations. However, we cannot separately identify the hours worked before and after the hospitalization, limiting our ability to draw conclusions about hospitalization effects on youth labor supply decisions.[21] The results of these regressions, as well as those using the health insurance coverage of the youth, are available from the authors upon request.

Despite the data limitations and the complexities of the underlying human capital formation function, we can begin to unravel some of the potential transmission mechanisms with the data available in the NLSY97. We attempt to reveal some of the mechanisms by investigating how the effects of household hospitalization are mediated or magnified by other characteristics of the youth or the household.

[21] There is some information about why students choose to dropout of school in the NLSY97. Among dropouts in the hospitalization sample, men are somewhat more likely to list "Financial difficulties, couldn't afford to go", "Entered the military", and "Offered a job" than women (19.2 percent compared to 9.3 percent) particularly if the male youth is the oldest (23.1 percent compared to 9.8 percent among oldest female youths). While not conclusive, this evidence is suggestive that men may be more likely to shoulder the burden of a hospitalization through the labor market.

4.1 The Role of Student Ability and Household Income

We begin by considering the influence of household income and student ability, the latter of which measures long term investments made in the youth. In either case, one might suspect that youth that are higher up in these two distributions may be more insulated from the negative effects of the hospitalization of a household member. To consider this possibility, we create indicators for whether the youth is in the top quartile of the respective distributions in the base year and then include that indicator as well as an interaction of the top quartile indicator with the household hospitalization indicator in our ordered probit model. Similar to the results in Table 3, in top panel of Table 4 we present both the coefficients of the household hospitalization and the interaction term, and we present the relevant marginal effects of the household hospitalization in the bottom panel for completing high school and completing a BA.

Overall, we do not find strong evidence that the base year income or ability of the student insulates them from a household hospitalization. The interaction term of our household hospitalization indicator and an indicator for being in the top quartile of the ability distribution is negative in column (1) suggesting potentially larger negative effects of a hospitalization among higher ability students. Neither the result, nor the marginal effects in the bottom panel, are statistically significant, likely capturing the fact that lower ability students are already constrained from completing higher levels of education due to their ability. Therefore a household hospitalization does not further lower their educational attainment.

In column (2) there is limited evidence that higher base year income may insulate youth as the coefficient on the interaction term is positive and the marginal effects of a household hospitalization are only statistically significant for those youth outside of the top quartile of household income. However, while not statistically significant, the marginal effects of a

household hospitalization are of a similar magnitude among those youth in the top income quartile. This result may simply represent the fact that the effects of means-tested government programs, college aid, and tax code provisions related to low-income households or health care expenditures make it difficult to identify the true at-risk population from a simple household income variable. Overall, the results do not strongly suggest that higher levels of household income protect youth from the negative effects of a household hospitalization.

4.2 The Mediating Role of Siblings

Youth could be insulated from household hospitalizations through the presence of siblings. If someone in the household becomes ill, then resources may be adjusted differentially across members of the household. In particular, additional responsibility may fall upon older siblings, either because they must spend time on care of other household members or they may need to increase labor market participation. Younger siblings may not be old enough to work or to be able to help with household responsibilities, for example, because they may lack a driver's license. This story relates to a large literature which has investigated the role of birth order on educational attainment (e.g. Behrman and Taubman 1986; Hanushek 1992; Black, Devereux and Salvanes 2005; Kantarevic and Mechoulan 2006). In general, the literature has found that older siblings, on average, have higher educational attainment than younger siblings. In contrast, one might be concerned that, in fact, the oldest child bears the brunt of a household hospitalization.

Because we can identify birth order among siblings in the data, we are able to test for a differential impact of household hospitalizations depending on whether the youth has siblings and where the youth falls in the birth order.[22] We create an indicator variable for whether the youth has any older siblings, including it and the interaction of the older sibling indicator with

[22] One might be concerned that birth order is correlated with age in the NLSY97 sample, if hospitalization affects children differentially across ages. However, we compared the age distributions among the "only", "oldest" and "younger" children, but we found no evidence that "older siblings" are actually older youth in the base year.

household hospitalizations in our ordered probit model.[23] In this specification, the hospitalization indicator without the interaction represents the effect of a hospitalization for those youth who are either the oldest of the children in the household or who are only children.[24] The results in column (3) of Table 4 indicate that the negative effects of a household hospitalization are concentrated among those children without an older sibling as the coefficient on the hospitalization indicator is negative and statistically significant. The marginal effects in Column (3a) suggest that a household hospitalization increases the likelihood of not completing high school by 3.8 percentage points among oldest or only children while the marginal effect for those youth with older siblings is small not economically or statistically significant. Similarly, the results in column (3b) suggest that a hospitalization of a household member reduces the probability of completing a bachelor's degree by 5.5 percentage points for only and oldest children while the marginal effect for those youth having an older sibling is -0.9 percentage, a result which is not statistically significant. These marginal effects among oldest and only children represent substantial declines, despite the fact that those youth who are the oldest or are the only child have higher overall educational attainment compared to those youth who are not first in the birth order. For example, in our sample 84.4 percent of older siblings complete high school compared to 81.8 percent of those youth without older siblings. Similarly, of those youth

[23] Separately including indicators for "only child", "oldest child" and "has older sibling" in our ordered probit model produces marginal effects of hospitalizations on not completing high school of 0.019 (0.044) for only children, 0.032 (0.024) for oldest siblings, and 0.006 (0.013) for younger siblings. Similarly, we find the marginal effects of hospitalizations on BA completion of -0.029 (0.061) for only children, -0.047 (0.031) for oldest siblings, and -0.011 (0.022) for younger siblings. While sample sizes reduce the precision of the estimates, these results separating only from oldest children suggest our estimates are not being driven by only children.

[24] There is a debate in the birth-order literature regarding the role of family size and birth order. The results in Table 4 utilize a specification in which the number of siblings, used in previous specifications, is replaced by an indicator for having an older sibling. However, family size variables are never statistically significant when included in these regressions and inclusion of these variables does not affect our results. This is broadly consistent with Black, Devereux, and Salvanes (2005), who find that family size is not significant conditional upon birth order.

who do not have an older sibling, 29.2 percent complete a bachelor's degree, compared to 26.8 percent completing a bachelor's degree among those youth with an older sibling.

In contrast, for those individuals with older siblings, the effect of a household hospitalization appears to be moderated. The interaction of household hospitalization and the older sibling indicator produces a positive and statistically significant coefficient in the top panel. The magnitude of the older sibling effect largely cancels the otherwise negative effect of a household hospitalization. The marginal effects in the lower panel show a similar pattern of moderating the impact of hospitalizations on not completing college in column (3a) and completing a bachelor's degree in column (3b). The results suggest that while those individuals earlier in the birth order may experience higher overall educational attainment, these same individuals also appear to be more vulnerable to the negative effects of a household hospitalization.[25] As discussed, these results are consistent with older siblings insulating younger siblings from the negative effects of household health events.

Position in the birth order is not the only way that siblings may impact the effect of household hospitalizations on youth educational attainment. Given the estimates previously presented in Tables 2 and 3 suggesting that household hospitalizations may disproportionately affect male youths, it is also possible that the gender composition of siblings could be important. Households could respond to a health event through increased home care responsibilities or increased labor force participation of the children, but could choose to allocate these changing responsibilities differently by gender. In column 4 of Table 4, we test this directly by including

[25] The prior literature on birth order effects (Black et al. 2005) finds that, on average, older children have higher educational outcomes. Our findings demonstrate that households adapt to health events by differentially shifting the burden to these oldest siblings. This suggests that in the absence of resource constraints, the positive benefits of being earlier in the birth order may be more pronounced than previously estimated.

an indicator for whether the youth has a brother, as well as an interaction with the hospitalization indicator.

The coefficients in the top panel in column (4) suggest that youth without brothers experience a decrease in educational attainment following a household hospitalization, while those youth with a brother are largely sheltered from the negative impact of a hospitalization. Similarly, the marginal effects in the lower panel in column (4a) suggest that those youth without a brother see a 4.3 percentage point increase in the likelihood of not completing high school following a hospitalization event. This effect is reduced to a statistically insignificant 0.8 percentage points if the youth has a brother. Similarly, for those youth without a brother, a hospitalization reduces the likelihood of completing a bachelor's degree by 6.7 percentage points in column (4b) while the marginal effect for those youth with a brother is only -1.3 percentage points and is not statistically significant.

Appendix Table A-4 presents the marginal effects of hospitalizations across the factors considered in Table 4 separately by gender. Consistent with the evidence that male youth are more susceptible to the negative effects of a household hospitalization, the results in Table A-4 highlight the vulnerability of male youth without older siblings or brothers to mitigate the hospitalization impact. Male youth without an older sibling experience a 6.2 percentage point decrease in the likelihood of completing high school and a 6.4 percentage point decrease in the likelihood of completing a bachelor's degree. Similarly large effects are found for male youth without brothers. By comparison, we find less pronounced and statistically insignificant effects for women. These results suggest that in addition to shifting the burden to the older siblings, households may respond to hospitalizations by shifting the burden to the male youth within the household, which is consistent with the larger impacts we estimate overall for male youths in our

sample. As we have discussed, these results could reflect male youth being an at-risk population or may suggest that increased care responsibilities, typically associated with women, may not be the primary mechanism through which household hospitalizations impact youth educational attainment.

5. The Effect of Household Hospitalizations on Other Youth Outcomes

5.1 College Choice

Household health events could affect educational attainment, not only through college attendance, but also through college choice. There is increasing evidence that college quality affects degree completion (e.g. Brewer, Eide and Ehrenberg 1999; Light and Strayer 2000; Black and Smith (2004, 2006); Hoekstra 2009). Additionally, there is evidence that college choice is affected by household resources (e.g. Belley and Lochner 2007; Lovenheim and Reynolds (2011, 2013)). Lower household resources could lead to students choosing lower-quality but less-expensive colleges. In this section, we investigate the possibility that household hospitalizations affect college choice among the set of students that attend college.

As there are many dimensions upon which students could change college decisions, we consider two different college choice measures. First, we estimate how household hospitalizations affect the likelihood of attending a two-year college instead of a four-year institution. Two-year colleges may be an attractive option for students from households with hospitalizations for several reasons. Primarily, two-year colleges are significantly cheaper than four-year colleges. In-state tuition and required fees at public two-year colleges during the 2009-2010 academic year averaged $2,136 compared to $6,695 at public four-year colleges. Additionally, students may be more likely to live at home and therefore not pay the additional

$8,319 in room and board fees at public four-year colleges.[26] In addition to cost savings, two-year colleges also may provide more flexible schedules, which may be helpful for students who have had to increase labor supply to supplement household income, or for students who need to provide care for a household member. Switching from the four-year to the two-year sector is of particular concern because there is growing evidence that two-year college attendance is associated with large negative effects on educational attainment (Kane and Rouse 1995; Long and Kurlaender 2009; Reynolds 2012).

We construct an indicator that takes a value of one if the first college attended is a two-year college and then use this as the dependent variable in a probit on the household hospitalization indicator and previous set of covariates.[27] We estimate the model for those students who attend college, consequently the marginal effects in the first column of Table 5 can be interpreted as the effect on the likelihood of attending a two-year college relative to a four-year college.[28] As expected, higher household income and student ability is associated with a lowered likelihood of two-year college attendance. Additionally, a one-week hospitalization of a household member increases the likelihood of two-year college attendance by 5.4 percentage points. Given that the 40.5 percent of college attendees in our sample begin their college career at a two-year college, the estimated effect is equivalent to a 13.3 percent ($= \frac{0.056}{0.405} \times 100$) change relative to the baseline. This is a substantial change in the likelihood of two-year college

[26] Author's calculations from the *Digest of Education Statistics, 2010.*

[27] There is a potential timing concern in which hospitalizations could temporally follow college choice, similar to concerns for high school completion and college attendance we have previously discussed. Restricting the ages of the college attendance limits this possibility but further limits a small sample, so we choose to not use age restrictions in the results that we report. However, imposing age restrictions does not substantively change our results suggesting that this timing concern is not driving our estimates.

[28] Because one might be concerned about bias arising from excluding non-attenders when estimating the effect of household hospitalizations on two-year college attendance, we also estimated a multinomial logit model using non-attendance, two-year attendance and four-year attendance as our outcomes. The results of this model are consistent with the estimates we present in Table 5 from the probit regression. For simplicity, we only present the probit results but the multinomial logit results are available upon request.

attendance, equivalent to a substantial decrease in household income or AFQT score, both of which have been identified as important determinants of two-year college attendance (e.g. Belley and Lochner (2007), Lovenheim and Reynolds (2011)).

College type is only one margin on which a household hospitalization could alter student choice. Students could also be forced into a different choice set of institutions based on price or convenience. To attempt to capture the myriad ways in which the college choices of students are changed by household hospitalizations, we also investigate college location. A household health event could force students to attend a college closer to home for a variety of reasons. Nearby colleges may be cheaper either because students qualify for in-state or in-district tuition and fees, which are lower than out-state tuition, or because the nearby colleges may be lower quality schools, such as two-year college or commuter public four-year institutions that also are less expensive. Additionally, students may need to live at home and commute to a nearby college, either to further reduce expenses or because they need to aid in the care of a sick household member. In any case, having the choice set limited to nearby colleges could result in lower-quality options or in a lower-quality match between student and college.

To investigate the potential change to the college choice set, we estimate the effect of a household hospitalization on the distance between the college attended and the location of the household. We measure the distance as the crow flies based on the population-weighted centroids of the county of residence of the youth at age 17 and the county in which the college attended is located. The second column of Table 5 presents the results of an OLS regression of college distance, measured in miles, on the set of explanatory variables used in our previous models. The results show that household hospitalizations do not affect the distance to college for the average student experiencing a household hospitalization.

However, distance to college attended is a function not only of the choice of the student but also the availability of local colleges where the student lives. Youth in larger cities will have more local college options than youth in smaller cities or rural areas and, therefore, may be more likely to find quality matches among nearby institutions. Thus, youth in larger cities are less likely to be constrained by having to attend a college closer to home. To account for this difference, we replace the indicators for suburban and rural household location with a single indicator for whether the student lives in a MSA. We then interact the MSA indicator with the hospitalization indicator to differentiate the behavioral response to a hospitalization event for youth based on access to local college options. The results of this specification are presented in column 3 of Table 5. The MSA indicator indicates that students in a MSA on average attend a college that is 54 miles closer than students in non-MSAs, consistent with students in a MSA having greater local options for college attendance. This differential access affects the impact of a hospitalization on college choice. Students outside of MSAs, who have fewer local college options, are likely to attend a college that is 80 miles closer, following a household hospitalization. This effect largely disappears for students in a MSA following a household hospitalization. We take this as further evidence that the college choice sets of students are affected by household hospitalizations, leading to lower-quality matches between students and colleges. These poor matches may be manifest in lower degree attainment and subsequent labor market earnings.

5.2 Future Earnings

The declines in educational attainment and changes in college choice should have substantial impacts on future earnings given the large returns to educational attainment and college choice found in the literature. To document exactly how much future earnings could be

affected, we estimate OLS regressions of earnings on late adolescence household hospitalizations, including in the specification the same covariates used to estimate the educational attainment effects. To measure earnings, we calculate hourly wage, hourly compensation (hourly wage plus overtime and performance pay), and annual income all in 2007.[29] As our interest is in measuring the total impact of hospitalizations on future wages, we do not control for mediating variables that are impacted by household hospitalizations such as the educational attainment of the youth. We use the natural log of these variables as dependent variables in the specifications and report the results in Table 6. The estimates show large negative effects of household health events during adolescence on all three measures of future income. The estimates suggest that future earnings are approximately 4 to 9 percent lower for those students for whom a household member was hospitalized for at least a week when the youth was younger. It is important to note that these estimated effects are relatively early in the career (the students are approximately 22-28 years old in 2007), and it is possible that the effects could be magnified over the course of their careers. Controlling for differences in educational attainment and experience in Appendix Table A-5 reduces the magnitude of the estimated effects, but the results suggest that household hospitalizations may lower future earnings through channels other than educational attainment, perhaps by affecting the quality of education, limiting geographic mobility or affecting occupational choice.[30] While the previous literature has focused on the role of parental socio-economic standing and youth health on subsequent earnings (see Currie (2009)), the results in Table 6 present a different pathway through which a family health event can impact future earnings.

[29] Income data from the 2008 survey year is retrospective from 2007. Additionally, use of 2007 income data avoids distortionary effects of the recent recession on measured income.
[30] In Appendix Table A-5, educational attainment and experience are measured by 2007 to be consistent with the timing of the income measures.

6. Conclusion

We add to a small but growing literature investigating how health events afflicting other household members impact the educational attainment of the children living in the household. We find evidence that a one-week household hospitalization significantly lowers the probability of graduating from high school, of attending college, and of graduating from college. The magnitude of the estimated hospitalization effect is comparable to a large decrease in annual household income or student test scores in its impact on the probability of completing college, suggesting economically serious consequences for students in households experiencing hospitalizations. Additionally, we find the negative impact of hospitalizations on high school and college completion to be particularly large for male youths. We also find evidence that these hospitalization events may restrict the college choices of youth who attend college and lower future earnings of all youth who experience hospitalizations, as would be expected given the changes in educational outcomes of the youth. We find no evidence that our hospitalization measure is proxying for poor unobserved youth or household health, conditional on the controls, and sensitivity analyses suggest that an implausibly large selection on unobservable characteristics would be required to eliminate our results.

The size of the estimated effects of a household hospitalization on youth's attainment of various educational outcomes suggest that interventions targeted at shielding at-risk students might be highly cost-effective policies. To correctly formulate policy, researchers need to identify the channels through which household health events affect youth educational outcomes. We present initial evidence about potential mechanisms by interacting the household hospitalization indicator with youth and household characteristics. We demonstrate that the presence of an older sibling in the family provides considerable protection for younger family

members. However, this protection is provided at significant cost to the oldest sibling. Similarly, having a brother appears to insulate the youth from some of the negative effects of a hospitalization, particularly for male youth. This provides some evidence that the transmission mechanism might occur through the oldest child or male children increasing labor force participation, increasing time devoted to home care, or otherwise shouldering the additional burden on the family.

To fully identify the many channels through which youth are affected by a hospitalization event requires additional research. The data requirements to do so are significant; researchers will need detailed income and insurance information, time use surveys, and labor force participation data. However, disentangling the complex transmission channels has critical policy implications. Should the primary transmission be through the cost of the hospitalization or subsequent convalescence, more extensive health or disability insurance might be the appropriate policy response. If, instead, the main mechanism is through lowered household income, then a means-based transfer program, such as student aid, may be more effective. It is also possible that the detrimental effects operate by diminishing the available time for direct parental investment in child human capital or by placing obligations on the child, which lowers time available to study. In these cases, the appropriate policies could include school based interventions such as tutoring or additional counselor involvement with students who have experienced household health events. While the data limitations of the NSLY97 prevent the investigation of these issues, our initial estimates of the substantial and detrimental effects of a household hospitalization on the educational attainment of youth suggest that this is an important area for continuing research.

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Table 1: Summary Statistics of Selected Variables and Educational Outcomes

	Full Sample		Hospitalization Sample		Non-hospitalization Sample		
Variable	Mean	St. Err.	Mean	St. Err.	Mean	St. Err.	Difference
Hospitalization	0.166	0.006					
Nuclear Family Hospitalization	0.118	0.006	0.712	0.019			
AFQT score	52.156	0.495	50.587	1.216	52.468	0.542	-1.881
Family income ($10,000)	6.991	0.100	6.622	0.262	7.065	0.108	-0.443
Family net worth ($10,000)	23.103	1.064	21.486	2.679	23.425	1.160	-1.939
Female	0.501	0.009	0.514	0.021	0.499	0.010	0.015
White	0.712	0.007	0.686	0.018	0.717	0.008	-0.031
Black	0.133	0.005	0.144	0.012	0.130	0.005	0.014
Hispanic	0.110	0.004	0.109	0.011	0.110	0.005	-0.001
Other race	0.046	0.004	0.062	0.011	0.042	0.004	0.019
Mother years of schooling	13.059	0.044	13.025	0.117	13.066	0.048	-0.041
Father years of schooling	13.080	0.052	12.935	0.134	13.109	0.056	-0.173
Number of siblings	1.354	0.019	1.355	0.047	1.353	0.021	0.002
Youth health limitation	0.080	0.005	0.104	0.013	0.075	0.005	0.028**
Youth underweight	0.195	0.007	0.197	0.017	0.195	0.008	0.002
Youth overweight	0.118	0.005	0.128	0.014	0.116	0.006	0.013
Youth obese	0.052	0.004	0.068	0.010	0.049	0.004	0.019*
Parent health limitation	0.142	0.006	0.201	0.017	0.130	0.007	0.070***
Parent underweight	0.016	0.002	0.017	0.005	0.015	0.002	0.001
Parent overweight	0.311	0.008	0.304	0.019	0.312	0.009	-0.008
Parent obese	0.240	0.007	0.279	0.019	0.232	0.008	0.047**
Youth has chronic condition	0.114	0.006	0.138	0.015	0.110	0.006	0.028*
Youth has asthma	0.093	0.005	0.112	0.014	0.089	0.005	0.023
Youth has heart condition	0.008	0.002	0.013	0.005	0.007	0.002	0.006
Youth has anemia	0.002	0.001	0.002	0.001	0.002	0.001	0.000
Youth has diabetes	0.003	0.001	0.002	0.002	0.004	0.001	-0.002
Youth has cancer	0.002	0.001	0.002	0.002	0.002	0.001	0.001
Youth has other chronic condition	0.010	0.002	0.008	0.003	0.011	0.002	-0.003
HS, public	0.891	0.005	0.891	0.013	0.891	0.006	0.000
HS, student-faculty ratio 22+	0.140	0.006	0.155	0.016	0.137	0.006	0.018
Outcomes							
HS diploma	0.817	0.007	0.777	0.017	0.825	0.007	-0.048***
Attend college	0.628	0.008	0.579	0.021	0.637	0.009	-0.058**
BA	0.280	0.008	0.234	0.018	0.289	0.009	-0.055***
Years of schooling	13.716	0.046	13.454	0.115	13.768	0.050	-0.314**
Observations	3862		652		3210		

Notes:
1) Summary statistics are calculated with sampling weights.
2) The last column presents the difference in mean value for the hospitalized and non-hospitalized samples. Asterisks denote statistical significance at the 10% (*), 5% (**) and 1% (***) levels.

Table 2: Estimates of the Effects of Household Member Hospitalizations on Youth Educational Attainment

	Years of Schooling		HS Diploma		Attend College		BA	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
OLS								
Hospitalization	-0.142	-0.316***						
	(0.099)	(0.133)						
Hospitalization*female		0.341*						
		(0.197)						
Probit								
Hospitalization			-0.016		-0.032		-0.040*	
			(0.016)		(0.024)		(0.022)	
Hospitalization, male				-0.051*		-0.032		-0.066***
				(0.028)		(0.036)		(0.023)
Hospitalization, female				0.015		-0.031		-0.007
				(0.020)		(0.033)		(0.035)
Propensity score matching								
Hospitalization	-0.129*		-0.025		-0.028		-0.029*	
	(0.092)		(0.019)		(0.019)		(0.016)	
Hospitalization, male		-0.283**		-0.069**		-0.031		-0.045**
		(0.136)		(0.027)		(0.026)		(0.020)
Hospitalization, female		0.068		0.020		-0.017		-0.006
		(0.136)		(0.026)		(0.026)		(0.025)
Observations	3831		3008		3676		3862	

Notes:
1) Regressions include AFQT scores, household income and net worth, youth and parent health measures, including indicators for chronic conditions, sex and race indicators, father and mother years of schooling, number of siblings, measures of high school type and teacher-student ratio, indicators for living in a rural area of non-central city, and age fixed effects. All regressions are estimated using sampling weights.
2) Marginal effects estimated at the mean are presented for probit estimates. For interaction terms, we report the marginal effect of hospitalization evaluated at each of the values of the binary interaction term.
3) Robust standard errors are provided below point estimates or marginal effects. Asterisks denote statistical significance at the 10% (*), 5% (**) and 1% (***) levels.
4) Propensity score matching estimates are produced using kernel matching with an Epanechnikov kernel. The propensity score is estimated using a logit including the same covariates as in the regression results. The bandwidth is selected using leave-one-out cross –validation. Standard errors are bootstrapped using 1000 replications.
5) High school completion is measured by age 20 and the sample is restricted to those youth aged 12-15 in the base year. College completion is measured by age 21 and the sample is restricted to those youth aged 12-16 in the base year.

Table 3: Ordered Probit Estimates of the Effect of Household Hospitalizations on Youth Educational Attainment by Gender and by Member of Household Hospitalized

Coefficients	(1)		(2)		(3)	
Hospitalization	-0.113**		-0.202***			
	(0.056)		(0.076)			
Hospitalization*female			0.176			
			(0.110)			
Father hospitalization					-0.234	
					(0.153)	
Father hospitalization*female					0.238	
					(0.232)	
Mother hospitalization					-0.203	
					(0.130)	
Mother hospitalization*female					0.619***	
					(0.180)	
Sibling hospitalization					-0.376**	
					(0.145)	
Sibling hospitalization*female					0.203	
					(0.268)	
N	3862		3862		3862	
Marginal Effects	(1a) Less than HS	(1b) BA	(2a) Less than HS	(2b) BA	(3a) Less than HS	(3b) BA
Hospitalization	0.020**	-0.034**				
	(0.010)	(0.017)				
Hospitalization, male			0.044**	-0.051***		
			(0.018)	(0.018)		
Hospitalization, female			0.004	-0.008		
			(0.012)	(0.026)		
Father hospitalization, male					0.053	-0.058*
					(0.039)	(0.034)
Father hospitalization, female					-0.000	0.001
					(0.026)	(0.056)
Mother hospitalization, male					0.045	-0.051*
					(0.032)	(0.030)
Mother hospitalization, female					-0.047***	0.149***
					(0.011)	(0.048)
Sibling hospitalization, male					0.091**	-0.087***
					(0.041)	(0.028)
Sibling hospitalization, female					0.030	-0.052
					(0.041)	(0.064)

Notes:
1) Ordered probit is estimated with sampling weights on four categories of educational attainment: less than HS, HS diploma, AA, and BA. Marginal effects are calculated at the mean of all variables for the lowest category ("less than HS diploma") and highest category ("completed BA"). For interaction terms, we report the marginal effect of hospitalization evaluated at each of the values of the binary interaction term.
2) Robust standard errors are reported in parentheses under coefficients and marginal effects. Asterisks denote statistical significance at the 10% (*), 5% (**) and 1% (***) levels.
3) The model includes AFQT scores, household income and net worth, youth and parent health measures, including indicators for chronic conditions, sex and race indicators, father and mother years of schooling, number of siblings, measures of high school type and teacher-student ratio, indicators for living in a rural area of non-central city, and a quadratic in age.

Table 4: Ordered Probit Estimates of Factors Mitigating the Impact of Household Hospitalizations on Youth Educational Attainment

Coefficients	(1)		(2)		(3)		(4)	
Hospitalization	-0.086		-0.112*		-0.198**		-0.231**	
	(0.059)		(0.060)		(0.082)		(0.095)	
Hospitalization * top AFQT quartile	-0.103							
	(0.139)							
Hospitalization * top income quartile			0.018					
			(0.147)					
Hospitalization * has older sibling					0.166			
					(0.110)			
Hospitalization * has brother							0.188*	
							(0.116)	
N	3862		3862		3862		3862	
Marginal Effects of Hospitalizations	(1a)	(1b)	(2a)	(2b)	(3a)	(3b)	(4a)	(4b)
	Less than HS	BA	Less than HS	BA	Less than HS	BA	Less than HS	BA
Below top AFQT quartile	0.021	-0.021						
	(0.015)	(0.014)						
Top AFQT quartile	0.016	-0.074						
	(0.012)	(0.049)						
Below top income quartile			0.022*	-0.031*				
			(0.013)	(0.016)				
Top income quartile			0.014	-0.031				
			(0.021)	(0.043)				
No older sibling					0.038**	-0.055**		
					(0.017)	(0.022)		
Has older sibling					0.005	-0.009		
					(0.013)	(0.022)		
No brother							0.043**	-0.067***
							(0.019)	(0.026)
Has brother							0.008	-0.013
							(0.013)	(0.019)

Notes:
1) Ordered probit is estimated with sampling weights on four categories of educational attainment: less than HS, HS diploma, AA, and BA. Marginal effects are calculated at the mean of all variables for the lowest category ("less than HS diploma") and highest category ("completed BA"). For interaction terms, we report the marginal effect of hospitalization evaluated at each of the values of the binary interaction term.
2) Robust standard errors are reported in parentheses under coefficients and marginal effects. Asterisks denote statistical significance at the 10% (*), 5% (**) and 1% (***) levels.
3) The model includes AFQT scores, household income and net worth, youth and parent health measures, including indicators for chronic conditions, sex and race indicators, father and mother years of schooling, number of siblings, measures of high school type and teacher-student ratio, indicators for living in a rural area of non-central city, and a quadratic in age.

Table 5: Effect of Household Member Hospitalizations on Future College Choice

Variables	(1) Two-year first (1)	(2) Miles to College (2)	(3) Miles to College (3)
Hospitalization	0.054*	-8.765	-79.653**
	(0.032)	(20.304)	(35.430)
Hospitalization * In MSA			80.819*
			(41.743)
In MSA			-53.590**
			(26.821)
AFQT score	-0.007***	0.610*	0.544
	(0.001)	(0.367)	(0.370)
Household income ($10,000)	-0.004	2.945	2.347
	(0.003)	(1.909)	(1.925)
Household net worth ($10,000)	-0.000*	-0.067	-0.055
	(0.000)	(0.128)	(0.128)
Youth health limitation	0.069	26.729	25.838
	(0.053)	(43.856)	(43.621)
Parent health limitation	0.049	18.146	17.847
	(0.038)	(33.805)	(33.529)
Observations	2400	2360	2384

Notes:
1) The model in column (1) is estimated using probit regression and marginal effects are calculated at the mean of all variables. Columns (2) and (3) are estimated by OLS. All models are estimated with sampling weights.
2) Robust standard errors are reported in parentheses. Asterisks denote statistical significance at the 10% (*), 5% (**) and 1% (***) levels.
3) All regressions also include sex and race indicators, indicators for youth and parental weight (underweight, overweight, and obese), indicators for chronic conditions, father and mother years of schooling, number of siblings, measures of high school type and teacher-student ratio, and age fixed effects. The model in columns (1) and (2) also include indicators for whether the student lives in a non-MSA or a non-central portion of a MSA.

Table 6: Effects of Household Member Hospitalizations on Future Income

Variables	ln(Hourly Wage) (1)	ln(Hourly Compensation) (2)	ln(Income) (3)
HH hospitalization	-0.042	-0.057*	-0.086*
	(0.029)	(0.031)	(0.048)
AFQT score	0.003***	0.003***	0.006***
	(0.000)	(0.000)	(0.001)
Household income ($10,000)	0.010***	0.010***	0.013***
	(0.003)	(0.003)	(0.004)
Household net worth ($10,000)	0.000	0.000	0.001*
	(0.000)	(0.000)	(0.000)
Youth health limitation	-0.106**	-0.084	-0.113*
	(0.051)	(0.055)	(0.080)
Parent health limitation	-0.016	-0.044	-0.116**
	(0.034)	(0.033)	(0.054)
Observations	3112	3058	2979

Notes:
1) All models are estimated using OLS with sampling weights.
2) Robust standard errors are reported in parentheses. Asterisks denote statistical significance at the 10% (*), 5% (**) and 1% (***) levels.
3) All regressions also include sex and race indicators, indicators for youth and parental weight (underweight, overweight, and obese), indicators for chronic conditions, father and mother years of schooling, measures of high school type and teacher-student ratio, indicators for living in a rural area of non-central city, and age fixed effects.
4) All income and educational attainment variables are measured in 2007.

Table A-1: Marginal Effects from Probits of the Effects of Household Hospitalizations on Youth Educational Attainment

Variables	Years of Schooling (1)	HS Diploma (2)	Attend College (3)	BA (4)
Hospitalization	-0.142	-0.016	-0.032	-0.040*
	(0.099)	(0.016)	(0.024)	(0.022)
AFQT score	0.042***	0.004***	0.008***	0.006***
	(0.001)	(0.000)	(0.000)	(0.000)
Household income ($10,000)	0.047***	0.010***	0.018***	0.006***
	(0.009)	(0.003)	(0.003)	(0.002)
Household net worth ($10,000)	0.002**	0.001*	0.001***	0.000***
	(0.001)	(0.000)	(0.000)	(0.000)
Youth health limitation	-0.311**	-0.027	-0.122***	-0.099***
	(0.135)	(0.024)	(0.036)	(0.035)
Parent health limitation	-0.445***	-0.045**	-0.040	-0.090***
	(0.105)	(0.018)	(0.027)	(0.025)
Female	0.492***	0.033**	0.133***	0.095***
	(0.071)	(0.013)	(0.018)	(0.016)
Black	0.798***	0.099***	0.189***	0.081***
	(0.099)	(0.018)	(0.027)	(0.023)
Hispanic	0.613***	0.099***	0.153***	0.027
	(0.104)	(0.020)	(0.030)	(0.025)
Other race	0.626***	0.053	0.144***	0.095***
	(0.189)	(0.038)	(0.057)	(0.037)
Mother years of schooling	0.094***	0.007**	0.017***	0.016***
	(0.017)	(0.003)	(0.005)	(0.004)
Father years of schooling	0.106***	0.010***	0.021***	0.017***
	(0.016)	(0.003)	(0.004)	(0.004)
Number of siblings	-0.073**	-0.010*	-0.002	-0.012*
	(0.031)	(0.005)	(0.008)	(0.007)
HS, public	0.168	0.092***	0.072**	-0.021
	(0.120)	(0.017)	(0.029)	(0.025)
HS, student-faculty ratio 22+	-0.140	-0.020	0.002	-0.075***
	(0.101)	(0.019)	(0.027)	(0.024)
Non-MSA	0.181*	0.041**	0.033	0.016
	(0.110)	(0.019)	(0.028)	(0.024)
Non-central city MSA	0.211**	0.045***	0.049**	0.039**
	(0.085)	(0.015)	(0.022)	(0.019)
N	3831	3008	3676	3862

Notes:
1) Robust standard errors are provided below point estimates or marginal effects. Asterisks denote statistical significance at the 10% (*), 5% (**) and 1% (***) levels.
2) All regressions also include measures of youth and parent weight (underweight, overweight, obese), measures of youth chronic conditions and age fixed effects

Table A-2: Estimates of the Effects of Household Member Hospitalization on Youth Educational Attainment for those Youth with a High School Diploma

	All HS Graduates				HS Graduates by 2002			
	Years of Schooling		BA		Years of Schooling		BA	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
OLS								
Hospitalization	-0.082	-0.275**			-0.074	-0.261*		
	(0.098)	(0.131)			(0.108)	(0.148)		
Hospitalization*female		0.364*				0.315		
		(0.194)				(0.211)		
Probit								
Hospitalization			-0.045				-0.050	
			(0.028)				(0.034)	
Hospitalization, male				-0.084***				-0.088**
				(0.031)				(0.035)
Hospitalization, female				-0.004				-0.026
				(0.041)				(0.043)
Propensity score matching								
Hospitalization	-0.055		-0.028		-0.040		-0.034	
	(0.090)		(0.019)		(0.098)		(0.022)	
Hospitalization, male		-0.230*		-0.049*		-0.188		-0.042
		(0.130)		(0.028)		(0.144)		(0.031)
Hospitalization, female		0.114		-0.002		0.097		-0.019
		(0.133)		(0.029)		(0.143)		(0.032)
N	3109		3127		2781		2790	

Notes:
1) Regressions include AFQT scores, household income and net worth, youth and parent health measures, including indicators for chronic conditions, sex and race indicators, father and mother years of schooling, number of siblings, measures of high school type and teacher-student ratio, indicators for living in a rural area of non-central city, and age fixed effects. All regressions are estimated using sampling weights.
2) Marginal effects estimated at the mean are presented for probit estimates. For interaction terms, we report the marginal effect of hospitalization evaluated at each of the values of the binary interaction term.
3) Robust standard errors are provided below point estimates or marginal effects. Asterisks denote statistical significance at the 10% (*), 5% (**) and 1% (***) levels.
4) Propensity score matching estimates are produced using kernel matching with an Epanechnikov kernel. The propensity score is estimated using a logit including the same covariates as in the regression results. The bandwidth is selected using leave-one-out cross –validation. Standard errors are bootstrapped using 1000 replications.

Table A-3: Estimates of the Effects of Household Member Hospitalizations on Youth Educational Attainment in the Imputation Sample

	Years of Schooling		HS Diploma		Attend College		BA	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
OLS								
Hospitalization	-0.159**	-0.393***						
	(0.079)	(0.107)						
Hospitalization*female		0.468***						
		(0.159)						
Probit								
Hospitalization			-0.027*		-0.038***		-0.032***	
			(0.017)		(0.008)		(0.007)	
Hospitalization, male				-0.068***		-0.047		-0.060***
				(0.025)		(0.030)		(0.017)
Hospitalization, female				0.017		-0.030		0.003
				(0.017)		(0.026)		(0.026)
Propensity score matching								
Hospitalization	-0.129*		-0.024*		-0.030**		-0.024**	
	(0.072)		(0.015)		(0.015)		(0.012)	
Hospitalization, male		-0.318***		-0.058**		-0.030		-0.045***
		(0.099)		(0.023)		(0.021)		(0.015)
Hospitalization, female		0.067		0.012		-0.028		-0.002
		(0.103)		(0.020)		(0.021)		(0.018)
Observations	5216		4636		5692		6034	

Notes:
1) Regressions include AFQT scores, household income and net worth, youth and parent health measures, including indicators for chronic conditions, sex and race indicators, father and mother years of schooling, number of siblings, measures of high school type and teacher-student ratio, indicators for living in a rural area of non-central city, and age fixed effects. All regressions are estimated using sampling weights.
2) Marginal effects estimated at the mean are presented for probit estimates. For interaction terms, we report the marginal effect of hospitalization evaluated at each of the values of the binary interaction term.
3) Robust standard errors are provided below point estimates or marginal effects. Asterisks denote statistical significance at the 10% (*), 5% (**) and 1% (***) levels.
4) Propensity score matching estimates are produced using kernel matching with an Epanechnikov kernel. The propensity score is estimated using a logit including the same covariates as in the regression results. The bandwidth is selected using leave-one-out cross –validation. Standard errors are bootstrapped using 1000 replications.
5) High school completion is measured by age 20 and the sample is restricted to those youth aged 12-15 in the base year. College completion is measured by age 21 and the sample is restricted to those youth aged 12-16 in the base year.

Table A-4: Marginal Effects of Hospitalizations from Ordered Probit Estimates of Factors Mitigating the Impact of Household Hospitalizations on Youth Educational Attainment by Gender

	(1a) Less than HS	(1b) BA	(2a) Less than HS	(2b) BA	(3a) Less than HS	(3b) BA	(4a) Less than HS	(4b) BA
Male								
Below top AFQT quartile	0.058**	-0.042***						
	(0.025)	(0.016)						
Top AFQT quartile	0.021	-0.073						
	(0.019)	(0.059)						
Below top income quartile			0.054**	-0.053***				
			(0.021)	(0.018)				
Top income quartile			0.016	-0.029				
			(0.034)	(0.059)				
No older sibling					0.062**	-0.064***		
					(0.027)	(0.023)		
Has older sibling					0.027	-0.035		
					(0.024)	(0.028)		
No brother							0.074**	-0.079***
							(0.034)	(0.029)
Has brother							0.026	-0.032
							(0.020)	(0.023)
Female								
Below top AFQT quartile	-0.004	0.005						
	(0.018)	(0.025)						
Top AFQT quartile	0.011	-0.073						
	(0.014)	(0.080)						
Below top income quartile			-0.000	0.000				
			(0.014)	(0.028)				
Top income quartile			0.011	-0.029				
			(0.025)	(0.063)				
No older sibling					0.020	-0.040		
					(0.021)	(0.039)		
Has older sibling					-0.010	0.021		
					(0.015)	(0.034)		
No brother							0.020	-0.046
							(0.021)	(0.044)
Has brother							-0.005	0.011
							(0.015)	(0.032)
N	3862		3862		3862		3862	

Notes:
1) Ordered probit is estimated with sampling weights on four categories of educational attainment: less than HS, HS diploma, AA, and BA. Marginal effects are calculated at the mean of all variables for the lowest category ("less than HS diploma") and highest category ("completed BA"). For interaction terms, we report the marginal effect of hospitalization evaluated at each of the values of the binary interaction term.
2) Robust standard errors are reported in parentheses under coefficients and marginal effects. Asterisks denote statistical significance at the 10% (*), 5% (**) and 1% (***) levels.
3) The model includes AFQT scores, household income and net worth, youth and parent health measures, including indicators for chronic conditions, sex and race indicators, father and mother years of schooling, number of siblings, measures of high school type and teacher-student ratio, indicators for living in a rural area of non-central city, and a quadratic in age.

Table A-5: Effects of Household Member Hospitalizations on Future Income with Education and Experience Controls

Variables	ln(Hourly Wage) (4)	ln(Hourly Compensation) (5)	ln(Income) (6)
HH hospitalization	-0.026	-0.043	-0.042
	(0.029)	(0.031)	(0.043)
AFQT score	0.000	0.001	0.004***
	(0.001)	(0.001)	(0.001)
Household income ($10,000)	0.009***	0.007***	0.009**
	(0.003)	(0.003)	(0.004)
Household net worth ($10,000)	-0.000	0.000	0.001*
	(0.000)	(0.000)	(0.000)
Youth health limitation	-0.051	-0.017	0.002
	(0.050)	(0.054)	(0.075)
Parent health limitation	-0.003	-0.043	-0.105**
	(0.033)	(0.033)	(0.051)
Years of schooling	0.038***	0.038***	0.000
	(0.008)	(0.008)	(0.013)
HS diploma	-0.073*	-0.066	0.175***
	(0.043)	(0.041)	(0.062)
AA	0.036	0.034	0.380***
	(0.059)	(0.061)	(0.088)
BA	0.148**	0.084	0.612***
	(0.064)	(0.063)	(0.097)
Hours of experience (1,000)	0.026***	0.036***	0.111***
	(0.007)	(0.007)	(0.011)
Squared hours of experience	-0.000	-0.000**	-0.002***
	(0.000)	(0.000)	(0.000)
Observations	2972	2923	2853

Notes:
1) All models are estimated using OLS with sampling weights.
2) Robust standard errors are reported in parentheses. Asterisks denote statistical significance at the 10% (*), 5% (**) and 1% (***) levels.
3) All regressions also include sex and race indicators, indicators for youth and parental weight (underweight, overweight, and obese), indicators for chronic conditions, father and mother years of schooling, measures of high school type and teacher-student ratio, indicators for living in a rural area of non-central city, and age fixed effects.
4) All income, educational attainment and experience variables are measured in 2007.